



PNRR EMM – Earth Moon Mars Project – Task 1410.7

SELENE (Simulated Environment for Lunar Exploration and Natural dynamics Experiments)

Overview

The **SELENE** facility is a vacuum chamber (50 cm in diameter and 60 cm in height) designed to replicate key lunar surface conditions, including vacuum, temperature extremes, UV radiation, solar wind, and regolith-like soil behavior. It supports research on Moon's environmental dynamics, such as electrostatic dust transport, and provides a crucial testing platform for validating hardware and operational procedures, thereby helping to mitigate risks and advance technologies for future lunar missions.

Technical specifications

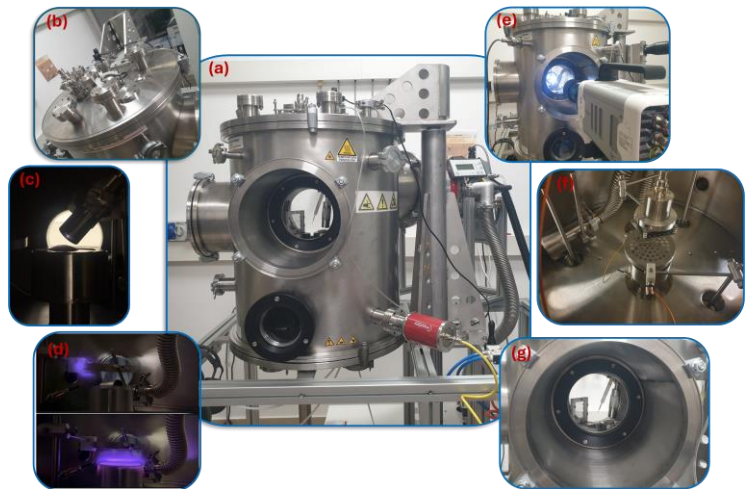
- Operating pressure: 10^{-6} mbar.
- Temperature: $-150\text{ °C} \leq T \leq +150\text{ °C}$.
- UV radiation: $\lambda = 162\text{ nm}, 172\text{ nm}$.
- Electron and ion fluxes: $E \leq 3\text{ keV}$.
- Suspended dust particles.
- Electric fields.

Diagnostics

- Environmental sensors: Faraday cup, Langmuir probe.
- High frame-rate and high-resolution camera.

Applications

- Study of the dust charging and levitation processes.
- Assessment of the degradation of space instrumentation in the lunar environment.
- Characterization of lunar dust analog and synthetic materials under lunar environmental conditions.



- (a) Selene facility.
- (b) Electron Guns (Beam energy: 10 - 1500 eV) and H_2^+ ion gun (Beam energy: 0 - 3000 eV) are used to reproduce the solar wind effect.
- (c) UV lamps: $E_{ph} > 5.5\text{ eV}$, i.e. the typical work function of the dusty surface to trigger photoelectron emission.
- (d) Plasma generation at a pressure of 10^{-2} mbar using high-voltage excitation.
- (e) A high-speed camera coupled to telecentric/macro lenses records the dust movement.
- (f) Faraday Cup characterizes electron and ion beams and measures the lofted dust grain charge.
- (g) Langmuir probe measures electron/ion temperature, plasma electron/ion density, and plasma potential.